NOTES ON THE ECOLOGY, PHENOLOGY AND DISTRIBUTION OF *POLLANISUS CYANOTUS* (MEYRICK, 1886) (LEPIDOPTERA: ZYGAENIDAE: PROCRIDINAE: ARTONINI)

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Abstract

New information is presented on the ecology and phenology of the zygaenid moth *Pollanisus cyanotus* (Meyrick, 1886). The known distribution of the species is extended to a site in the Baranduda ranges of northeastern Victoria. The previously unknown larva is described, with *Hibbertia obtusifolia* DC (Dilleniaceae) and *Hibbertia riparia* (R.Br. ex DC.) Hoogland (Dilleniaceae) recorded as larval food plants. A dipteran parasitoid is also noted. Observations are made in relation to adult behaviour and morphology.

Introduction

A population of *Pollanisus cyanotus* (Meyrick, 1886) was recently discovered by the author in northeastern Victoria. Initially, a series of adults was found (December 2010), followed by mature larvae on *Hibbertia obtusifolia* DC (Dilleniaceae) in February 2011. The site is at 380 m elevation, thinly forested with red stringybark (*Eucalyptus macrorhyncha* (F.Muell. ex Benth)) and a rocky understorey of mixed shrubs. Subsequently, during late autumn and early winter 2011, second instar larvae were found on *Hibbertia riparia* (R.Br. ex DC). In August and September 2011, both second and third instar larvae were found, followed in late October by larvae approaching maturity. While *Pollanisus* Walker spp. are notoriously difficult to identify, *P. cyanotus* is the only known Australian species in the genus in which the female abdominal tuft is grey; in all other known Australian species the tuft is yellow. Its identity was further confirmed by dissection of both male and female genitalia and comparison with the images and descriptions in Tarmann (2004). In the female, the 'tentacles' described by Tarmann are very evident.

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Pollanisus cyanotus is known primarily from locations in southern New South Wales, mainly from sites in the Sydney-Wollongong area, often coastal but also up to about 50 km inland. There are two records from southern Queensland, also from coastal regions. The only truly inland record is a specimen from 'Innaminna', which is assumed to be from a property of that name some 100 km NW of Dubbo, NSW. Until recently, *P. cyanotus* was known in Victoria only from two specimens, collected near Cann River and Hazelwood respectively. (All preceding distribution records are derived from Tarmann 2004). Recently, A. Kallies (pers. comm.) discovered a population of *P. cyanotus* near Malacoota, East Gippsland, where it was found in a coastal heath swamp. Here the population was associated with a small species of an unidentified *Hibbertia*; however, no direct proof was obtained that this was indeed the host plant. The current observations from NE Victoria represent a significant extension of the range of *P. cyanotus* in Victoria and the first host plant record. They also show a much wider habitat preference for this species than anticipated.

Methods

Observations of adults and larvae were made on private property approximately 5 km north of Yackandandah, Victoria (36°17.058S, 14°652.553E). Larvae were preserved first in KAA – Kerosene, Ethyl alcohol and glacial Acetic acid, then in 70% ethyl alcohol, following the method described by Tarmann (2004). A female, reared from larvae collected in February, emerged in March and was paired by assembling at the site; larvae from eggs she laid were reared in captivity. Genitalia dissection was as per Common (1990). Larval collection was most easily carried out by placing a net or sheet underneath the larval food plant which was then shaken.

Material examined

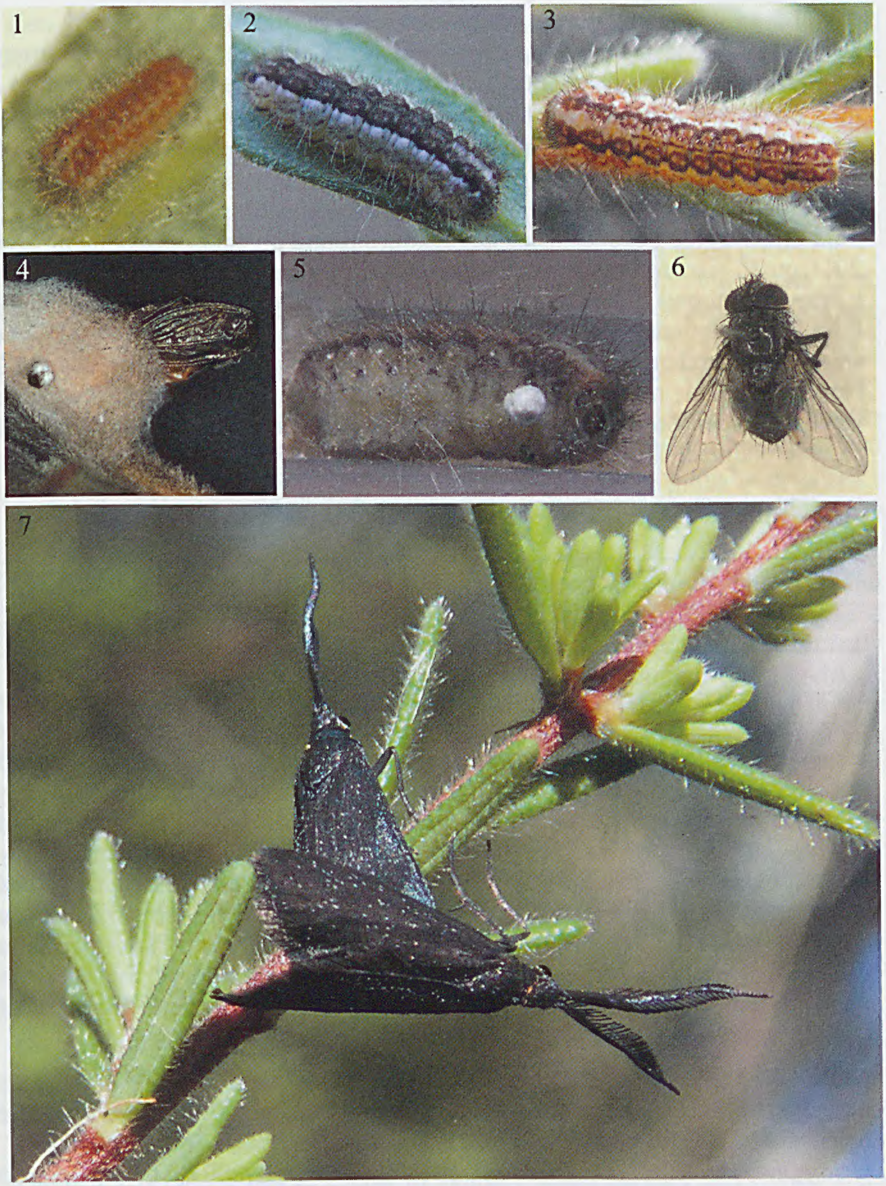
All from Baranduda ranges, north of Yackandandah, NE Victoria: immature and mature larvae (more than 50 found, 10 preserved) and adults (approximately 20 male and 3 female wild-caught specimens, approximately 10 of each gender retained from reared specimens); eggs obtained from a bred female; cocoons from larvae found in February 2011 and captive reared; microscope slides of male and female genitalia. All material is in the collection of the author.

Larval description

Mature larva: Length 10-10.5 mm. Verrucae (V) on all segments in three bands: Dorsal (D), Sub-Dorsal (SD) and Lateral (L). DV ringed with dark brown or black, SDV sometimes fully ringed, sometimes only partially ringed ventrally with dark brown; line between DV and SDV white, line ventrad of SDV white or light brown, dorsal area between two rows of DV white with interrupted dark brown mid-dorsal line on A1-8 and thoracic segment 3 but absent on thoracic segments 1 and 2, giving the appearance of the thorax bearing a pronounced white patch; LV ringed with dark purple-brown; venter translucent white; A9 on line between DV and SDV carries a small white protuberance, function unknown but similar in appearance to the white silk bead attaching to the cocoon. Figs 2-3 show two larval colour forms. The appearance of the white thorax is recognizable in all stages of larval development (Fig. 1 shows a second instar larva).

Adult morphology

The wings of freshly emerged adults are dusted with white scales. These markings are asymmetrical and the positioning of the white scales differed between each of the adults examined. The hind wing of the freshly emerged adult is sometimes green tinged, but this was not noticed in any wild caught specimens, which instead had a transparent, thinly scaled appearance. A pair of adults mating, resting on *H. riparia*, is shown in Fig. 7.



Figs 1-7. *Pollanisus cyanotus* and its parasitoid. (1) second instar larva of *P. cyanotus* showing the white thoracic colouration; (2-3) two colour forms of mature larvae of *P. cyanotus*; (4) cocoon of *P. cyanotus* with pupal exuviae, illustrating the partial darkening of the silk bead; (5) larva of *P. cyanotus* in early stage of cocoon construction showing bead placement; (6) tachinid fly parasitoid of *P. cyanotus*; (7) pair of *P. cyanotus* mating, at rest on *H. riparia*.

Phenology and ecology

In situ observations. Adults were initially seen on 12 December 2010, followed by the discovery of mature larvae on *H. obtusifolia* on 29 January, then on 3, 5 and 9 February 2011. The species is bivoltine at this location, with adults on the wing in late spring to early summer and again in March (the latest observed being 2 April). An adult male was observed feeding at flowers of *Monotoca scoparia* (Sm.) R.Br. (Ericaceae) (prickly broom-heath) on 2 April 2011. Second instar larvae were found on four occasions in May 2011 on *H. riparia* brought in to feed captive larvae. Second and third instar larvae were found in late August and early September 2011 on *H. riparia*; of three larvae found on 7 September 2011, two were 3 mm in length and one was just under 2 mm. All three were found on the underside of sepals. On 3 November 2011, mature larvae were commonly found on *H. riparia*. Adults were then seen on 28 and 29 November and in early December 2011. The complete annual lifecycle at this site is described in the following timeline, where A = adult, O = ova, L = larva, P = pupa; red text represents *in situ* observations and black text represents deductions:

O/L	L/P	P/A/O/L	A/O/L	L	L	L	L	L	L/P	P/A	A/O
Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec

Larvae located by searching were most easily found at dusk or soon after dark. However, they could also be found during the day on the underside of leaves and on the upperside where the plant was in a shaded or semi-shaded position. When moved into full sunlight for photography, they quickly retreated to the underside of the leaf. Feeding on *H. obtusifolia*, larvae grazed the top surface of the leaf, leaving the under surface of the leaf almost fully transparent. During late February, after mature larvae reared in captivity had all pupated, individual plants of *H. obtusifolia* on which many wild larvae had been observed were thoroughly searched, together with surrounds, to a radius of approximately 1 m; however, no cocoons could be found. From larvae found in February 2011, the mean time between commencement of cocoon construction to emergence of the adult was 18 days.

Captive rearing. In captivity, a fertile female provided with *H. obtusifolia* laid eggs on the underside of the leaf. As with other species of *Pollanisus*, the eggs were covered with the female's abdominal setae (pers. obs. – *P. viridipulverulenta*, *P. cupreus*, *P. apicalis*; Tarmann 2004). Larvae reared from the egg were at all times offered both species of *Hibbertia* present at the site and selected exclusively *H. riparia*. Eggs laid on 6 March hatched on 13 March and larvae matured quickly in captivity, with pupation commencing between 27 May and 19 June – a total development time of 75-97 days. In captivity, the mature larvae prior to pupation spent more than 24 hours wandering around the breeding container prior to locating a suitable pupation site, which was generally in a crevice on the under surface of the lid of the container. It appears likely, from the combined observations both in the wild and in captivity, that mature larvae move some distance from the food plant prior to forming a cocoon. Adults emerged from late June to late July.

Cocoon construction. The cocoon of *P. cyanotus* is white and carries at least one small bead of tightly woven silk on the outer case (Fig. 4). Similar structures have been observed on the cocoons of other *Pollanisus* species (Mollet and Tarmann 2010). However, this does not seem to be present in *P. viridipulverulenta* Guérin-Méneville, 1839 (pers. obs.). In some cases there was one main bead and several smaller silken nodules. When freshly spun, the entire bead is white; after a short period a portion of the bead assumes a dark brown or black colour. The function of the bead is not known.

Cocoon construction itself commences with the larva laying down a simple structure comprising very few single strands, then producing the silk bead and placing this on what will become the outside of the cocoon before finally completing the structure, thereby leaving the ball of silk on the outside of the cocoon (Fig. 5).

Adult behaviour. In March 2011, adult behaviour was closely observed and males were seen to fly freely in semi-shaded areas among the two larval food plants on site, *H. obtusifolia* and *H. riparia*, with the latter plant significantly preferred. Flight time was between early and late afternoon (*ca* 1800h). A female collected on 12 December 2010 was the only one observed in the 2010-2011 flight seasons. This was despite the fact that the species was known to be present at the site and the frequent visits made in March 2011.

In the following Spring–Summer season, 2 females were taken feeding at *Bursaria spinosa* (Cav.) on 29 December 2011, at the end of the first 2011-2012 adult brood. On 14 March 2012, visiting the site with A. Kallies, six females and eight males were taken in the late morning. Flight was generally close to the ground and males were rarely seen individually; 3 to 6 specimens were often seen flying in close proximity, exhibiting what appeared to be assembling behaviour (although no females could be located at the time).

On 5 March 2011, a freshly emerged female bred from a larva found in February was taken to the site around 1600h and used to attract males. This proved very effective, with more than 40 males coming to the female in the period between 1600h and 1700h at five different sites some 20 m apart.

Parasitoids. Of 14 larvae found in January and February 2011, two were parasitized by a tachinid fly (Diptera: Tachinidae) (Fig. 6), with a single adult tachinid emerging from each of the pupae. From pupae reared from eggs laid in captivity and reared on *H. riparia*, two further examples of the same parasitoid species emerged in early August 2011. It is likely that infection occurs by micro-oviparity, where eggs of the tachinid are deposited on the leaves of the food plant and subsequently ingested by the host.

It has not been possible to identify the tachinid to species or genus level; however it is likely to be a genus near *Austronilea* Crosskey in the tribe Eryciini (B. Cantrell pers. comm.).

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